

# Experimental Based Learning and Modeling of Computer Networks

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## ABSTRACT

Computer network experts are in great demand these days. This study aims to examine the effectiveness of using Cisco Packet Tracer as a simulation tool. This development reflected significant importance for higher education institutions. It ensures that all students have ample networking assistances. The computer network needs consideration of theory and practice. Hence, Cisco packet tracer software is recommended to solve this difficulty. In this paper, design and simulation of a computer network with Cisco network packet tracer simulation software is illustrated. This software would normally not work deprived of a variety of configurations. So, essential steps and configurations of software are explained in this paper which is useful in network design. Extensive simulation results validate this model.

**KEYWORDS:** Cisco packet tracer, simulation of LAN networks, protocol data units, protocol stack

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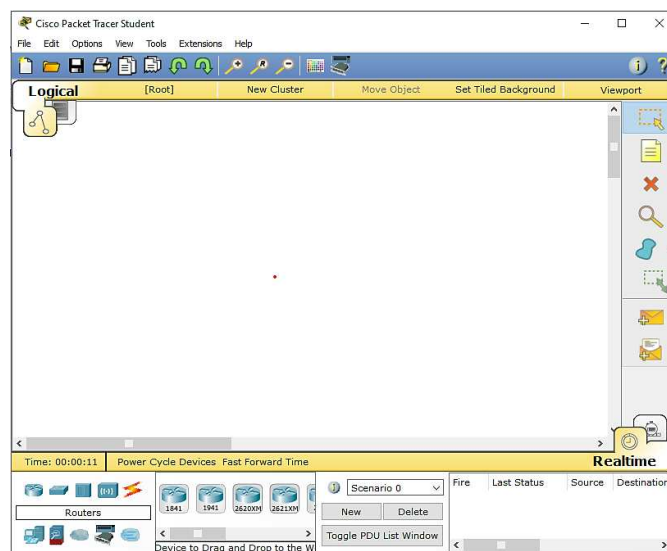
## 1. INTRODUCTION

Cisco is an organization that makes high-quality network devices. Therefore, the Cisco network is a very advance level of network connection based on innovative configurations that run on certain computers that use different OSI models. International organization for standardization (ISO) formed open system interconnection model [1]. The goal is to support providers to be able to exchange and make use of information network designs and simulation software in the method of procedures so that diverse provider networks can work together. This will become the challenge for all research community to follow a standard design and configurations.

The computer network is an essential topic in multiple engineering streams such as Software engineering, Computer Science, Electrical Engineering, Information technology and other programs. The Computer Networks area needs experts with a concrete network idea and hands-on knowledge. Besides the rapid scientific innovation in the field of computer connections and Information Technology engineering, the requirement for a considerable quantity of professionals in qualified networks also increased.

Therefore, simulation software is recommended to give a student of a network topic which gives knowledge involvement, and students can get the actual network background into the classroom to make it more collaborating and operational.

The software is very beneficial and inexpensive for the institutions. Cabling and physical connectivity cannot be studied by simulation software. Cisco Packet Tracer like tools developed by various corporations which also include a vast list of GNS3 and Boson NetSim and [3]. Presently in academics world Cisco Packet Tracer which is developed by Cisco extensively uses. The following figure shows the graphical user interface of the Cisco packet tracer software.



**Figure 1 Interface of Packet Tracer Simulation Software**

## 2. BACKGROUND OF THE STUDY

In today's computing world, networking is the training of connecting multiple nodes together to share data [4]. Networks are assembled using a combination of computing devices such as hardware and software. Information networks appeared as an outcome of commercial uses designed for small computers. At that phase, the small computers were not linked like computer workstations; therefore, data can't be shared efficiently. Using floppy disks was not an efficient or profitable way of doing business. Sneaker made several duplicates of the files. Every instant a file is modified, it has to be pooled with anyone else who requests it. If multiple persons modify the file and then attempt to share it, a change set is lost due to multiple modifications. Companies looked-for a resolution that could effectively answer the listed following challenges:

1. Repetition of work on devices and nodes must be avoided
2. To interconnect resourcefully
3. To configure and handle a network

Companies recognized that network machinery could increase efficiency and can be cost-effective. Computer Networks were designed and stretched almost as quickly as the latest technologies and network devices were presented [5]. In the early eighties, network creation was a major development, although the initial development of the networks was disorganized. Till the year 1980, the subsequent network technologies were presented with a variety of diverse hardware and software installations. Every business that manufactured the hardware and software of the computer network used their own standard. These separate standards were industrialized due to the race of profitability within the competing business firms. This results in many of the advance network designs were not suitable to synchronize with one another. Computer hardware that modified with different stipulations became increasingly difficult to connect with. This is frequently essential for the old network devices to be replaced with the new devices.

The first step solution to this problem was to create LAN (local area network) standards. Since the standards of local area network contained a number of open guidelines for the development of network hardware and software, devices from various businesses could become well-matched [6]. This allowed permanence in the LAN operation. In a local area network technology, every section in the firm is a set of network connections. As the usage of computers in various industries improved, it quickly resulted that even local area network technology was not enough.

## 3. METHODOLOGY

The network project in Cisco Packet Tracer cannot simulate in lacking information of nodes to communicate with another end device. Also, it requires information of cables to be used for connecting nodes together, that is, if it is a direct cable, a crossover, Cable or worse, the devices are configured not only by a network designer but also by an administrator of Cisco network. LAN network design for a room is simulated in this paper. Computer, switches and cables are used in the design and simulation of network.

As shown in figure 2, a hub is a central device of the network. Hub is connected to one laptop on the left-hand side and another two computers by using a copper cross over Cable.

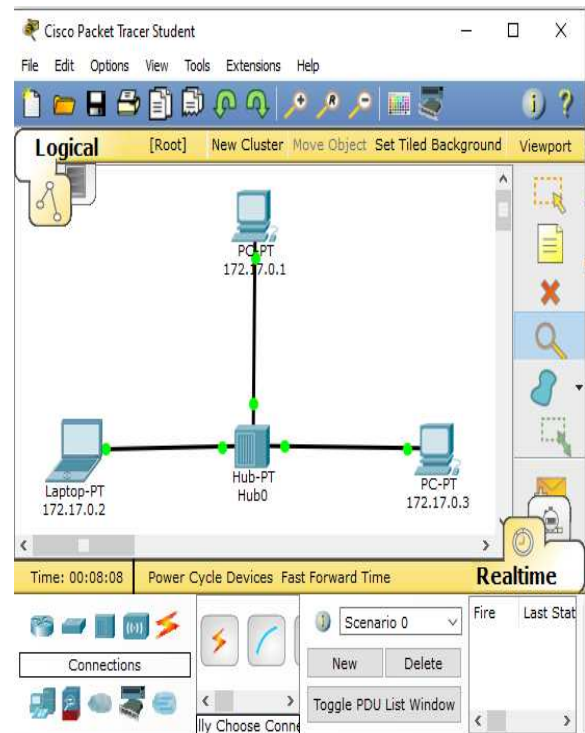


Figure 2 Network design for a one-room LAN Connection The hub connected to the computers provides the configuration of devices to be attached. This local area network designed to communicate between the three devices with advantage of speed, bandwidth and ease of connections.

### 3.1. Addressing and Network Design

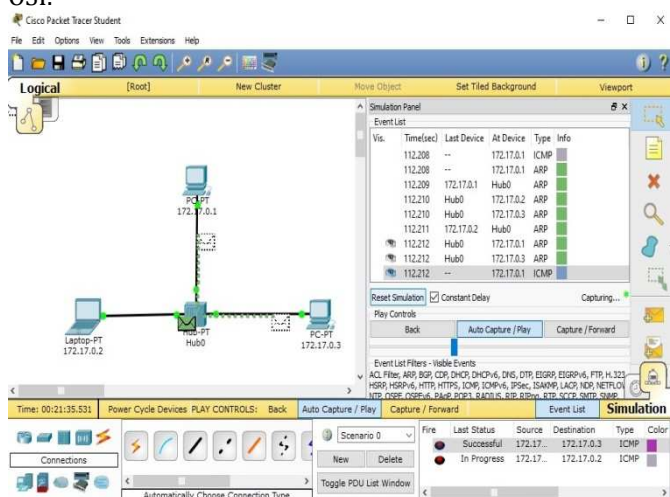
Figure 4 shows the use of static IP addresses of class 2 for designing the network. IP addresses of network devices are to be decided with same class only. Different classes are available for addressing such as Class A, Class B and Class C etc. For communicating two networks which work on different levels, a device called router is used.

If the number of hosts increases, a DHCP server can be easily configured for automatic addressing of hosts. Dynamic Host Configuration Protocol (DHCP) is a system in which protocol used to mobilize the way toward designing gadgets on IP systems, in this manner permitting them to organize administrations, for example, DNS, NTP, and any corresponding protocols like UDP or TCP.

Figure 3 IP Configurations of Hosts

### 3.2. Simulation of network

Using simulation mode, you can observe that packets travelling end to end on each node and you can also select packet to see protocol stack organized in layers by layer in OSI.

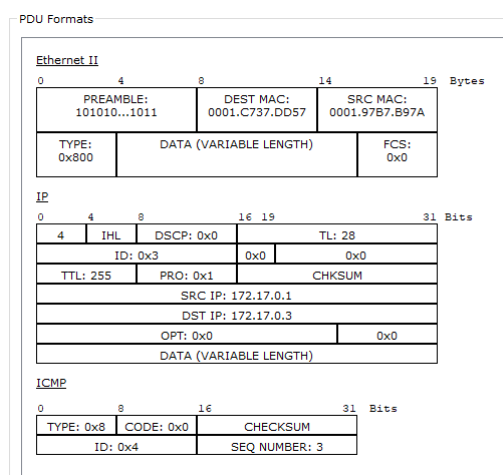


**Figure 4 Simulation of Network**

The hub in figure 4 has a multi-computer design which gives scope for development of the network. The figure shows the outbound PDU travelling from host to host that clearly indicates the communication between the computers connected in LAN network.

### 4. RESULTS AND DISCUSSIONS

We undertake an overview of Cisco network parameters at saturation points in networks which are susceptible to failures in network. For network architecture and simulations the research was taken place in packet tracer software. These are the prominent tools for network formation within the engineering designs. The results of this study would allow a network infrastructure engineer to introduce relatively higher safety networks free of unavoidable delays and able to optimize performance. The proposed alternative to the defined problems is introduced through modification of the OSPF routing protocol. Following figure shows protocol stack of network at different steps.



**Figure 5 Protocol Stack of Outbound PDU**

As shown in figure 5, the protocol stack of Outbound PDU indicates the various header field information for outgoing packets. Many times, a node will get a PDU and after this result is transferred out to outbound PDU.

### 5. CONCLUSION

Various network integration in the network provides many company organizational benefits. Through the convergence of computer, storage, application and network services in one operations center. This requires strict requirements for the design of the data center and the functions of the devices that need these facilities. This work provided a comprehensive analysis and development of the Cisco packet tracer simulated network that incorporates filtering, protection, and switching as a traffic management approach. Using the Cisco network simulator program (Packet Tracer), we build a Cisco network with networking and protection that would usually not operate without some modifications. The mandatory setting and addressing is shown in the paper. The local area network is tested with various simulation results. Results indicate that network, addressing and functioning is fully implemented in packet tracer. Therefore, the model is suggested for all computer network establishments or companies. As companies need a simple, robust and authenticated secure network. The scope of future work will be expanded in near future. This includes the design and configuration of the different protocols and networks which always meet the standard that any computer network society or business would need at any time. In addition, for security and efficiency the future work not only consists of designing and configuring a computer network but also of finding where that Cisco simulated network does not again meet the network standard.

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